



**LASER MAGNETIC STORAGE  
INTERNATIONAL COMPANY**  
**TAPE STORAGE DIVISION**

---

**49769050**

**STREAMING TAPE UNIT  
92181-05/15  
SMALL COMPUTER SYSTEM  
INTERFACE**

**SUPPLEMENTARY  
HARDWARE MAINTENANCE MANUAL**

**GENERAL DESCRIPTION**

---

A PHILIPS AND CONTROL DATA JOINT VENTURE



# REVISION RECORD

REVISION	DESCRIPTION
A (09-21-86)	Released.
B (03-20-87) Series Code 22 and up	ECO 52101 has no effect on this manual.
C (07-24-87) Series Code 27 and above	Series Codes 23 thru 26 are not used. ECO's 52097 and 52197 have no effect on this manual.
D (09-12-88) Series Code 27 and above	This revision incorporates ECO PB 52264C affecting pages: ii, iii, v.
PUB. NO. 49769050	Revision letters I, O, Q, S, X, and Z are not used.

c 1986, 87, 88  
By Laser Magnetic Storage  
International Company  
Printed in the United States  
of America

Address comments concerning this  
manual to:

Laser Magnetic Storage  
International Company  
Technical Publications Dept.  
2621 Van Buren Avenue  
Norristown, Pa. 19403

or use the comment sheet in the  
back of this manual.

# LIST OF EFFECTIVE PAGES

The revision level of each page is indicated by an alpha character located adjacent to the publication number at the bottom of each page. The revision level of a page will change when the content of the page has been affected by deletions or additions to the page. A bar in the margin indicates where the change has occurred. A dot near the page number indicates the entire page is affected, and a bar adjacent to the page number indicates pagination rather than content has changed.

PAGE	REV
Cover	D
ii	D
iii	D
Blank	-
v	D
Blank	-
vii	A
viii	A
ix	A
Blank	-
1-1	A
1-2	A
1-3	A
1-4	A
1-5	A
1-6	A
1-7	A
1-8	A
1-9	A
1-10	A
1-11	A
1-12	A
1-13	A
1-14	A
1-15	A
1-16	A
1-17	A
1-18	A
1-19	A

PAGE	REV
1-20	A
1-21	A
1-22	A
1-23	A
1-24	A
1-25	A
1-26	A
1-27	A
1-28	A
1-29	A
1-30	A
1-31	A
1-32	A
1-33	A
1-34	A
1-35	A
1-36	A
1-37	A
1-38	A
Comments	-
Mailer	-
Blank	-
Cover	-

PAGE	REV
------	-----



## PREFACE

---

This manual furnishes a basic technical description of the Small Computer System Interface employed on the 92181-05/15 streaming tape unit (STU). We assume that the user of this manual has had technical training and/or experience with peripheral device interfaces.

This manual is a supplement to the following manuals, which are available through Laser Magnetic Storage International Company Tape Storage Division.

### PUBLICATION

### PUBLICATION NO.

Streaming Tape Unit  
92181 Series  
    General Description  
    Operation  
    Installation and Checkout

49768900

Streaming Tape Unit  
92181 Vertical Mount  
    Theory of Operation  
    Diagrams  
    Maintenance  
    Parts Identification

49769000

Streaming Tape Unit  
92181 Horizontal Mount  
    Theory of Operation  
    Diagrams  
    Maintenance  
    Parts Identification

49769100

Additional information on the Small Computer System Interface (SCSI) may be obtained in ANSI STD X3.131-1986 available through the following address:

X3 Secretariat/CBEMA  
311 First N.W.  
Suite 500  
Washington, DC 20001



# CONTENTS

---

## Section 1 - GENERAL DESCRIPTION

<u>GENERAL DESCRIPTION</u>	1-1
OPTIONAL FEATURES	1-1
Adaptive Velocity Control	1-2
Reset SCSI Bus On Power-Up	1-2
SCSI Bus Arbitration	1-2
SCSI Bus Parity Checking	1-2
Assume Copy Disk Block Size 512	1-2
Loop On RAM DATA Dump	1-2
Auto Read and Write Error Recovery	1-2
POWER-ON DIAGNOSTICS	1-3
ON-LINE DIAGNOSTICS	1-4
RESET CONDITIONS	1-4
ERROR RECOVERY	1-4
RESELECTION TIMEOUT PROCEDURE	1-4
ADDRESSING	1-5
OPERATING MODE	1-5
PERFORMANCE	1-5
SCSI MESSAGES	1-6
SCSI STATUS	1-6
QUEING OF HOST REQUESTS	1-6
<u>COMMANDS</u>	1-7
COMMAND SET	1-7
TEST UNIT READY	1-8
REWIND	1-8
REQUEST SENSE	1-8
READ BLOCK LIMITS	1-9
READ	1-9
WRITE	1-12
READ REVERSE	1-15
WRITE FILE MARK	1-16
SPACE	1-17
INQUIRY	1-18
VERIFY	1-19
RECOVER BUFFERED DATA	1-19

# CONTENTS

---

## COMMANDS (Cont'd)

MODE SELECT	1-20
RESERVE UNIT	1-22
RELEASE UNIT	1-22
COPY	1-22
ERASE	1-24
MODE SENSE	1-25
LOAD/UNLOAD	1-26
RECEIVE DIAGNOSTIC RESULTS	1-26
SEND DIAGNOSTIC	1-27
WRITE DATA BUFFER	1-29
READ DATA BUFFER	1-29

## ELECTRICAL AND MECHANICAL INTERFACE 1-30

### SCSI CONNECTOR SIGNAL ASSIGNMENTS 1-30

#### Single-Ended Cable Pin Assignments 1-33

Alternative 1 Connector 1-33

Alternative 2 Connector 1-34

#### Differential Cable Pin Assignments 1-35

Alternative 1 Connector 1-35

Alternative 2 Connector 1-36

SYSTEM CONFIGURATION 1-37

SCSI TERMINATION 1-37



## FIGURES

---

<u>FIG. NO.</u>	<u>TITLE</u>	<u>PAGE</u>
1-1	SCSI Interface With Connectors	1-31
1-2	SCSI Interface Without Connectors	1-32
1-3	System Configuraton	1-37
1-4	Termination For Single-Ended Devices	1-38
1-5	Termination For Differential Devices	1-38



---

GENERAL DESCRIPTION

The Streaming Tape Unit (STU) interface is based on the Small Computer System Interface (SCSI) and executes the SCSI standard and extended commands for sequential access devices. It also implements many of the optional commands as listed in the command set functional description section of this manual.

The STU is interfaced to the SCSI bus by a buffered SCSI interface board with a buffer size of 64K (kilo) bytes. The interface supports the SCSI arbitration phase and transfers data in the asynchronous mode. Parity is maintained throughout the tape data bus (except SCSI chip) and the data buffer memory. The STU SCSI interface supports record sizes from 1 byte to 64K bytes in both fixed and variable length formats.

OPTIONAL FEATURES

The options available with the SCSI may be selected by means of switches located on the interface PWA. The switch options available on the SCSI interface PWA are listed below. For the location of the option switches, refer to Appendix A, 92181 Series Hardware Maintenance Manual, Publication No. 49768900.

	<u>State In Which Shipped</u>
- Adaptive Velocity Control	Enabled
- Reset SCSI Bus On Power-Up	Disabled
- SCSI Bus Arbitration	Enabled
- SCSI Bus Parity Checking	Enabled
- Assume Copy Disk Block Size 512	Disabled
- Loop On RAM DATA Dump	Disabled
- Auto Read and Write Error Recovery	Enabled

- a. Adaptive Velocity Control - When enabled and low speed is selected via the Mode Select command, the STU automatically adjusts its speed to maintain the most efficient data throughput. When disabled, the STU speed is determined by the speed set up in the Mode Select.
- b. Reset SCSI Bus During Power-Up - When disabled, does not reset the SCSI bus during power-up. When enabled, the STU generates a RESET which informs all other devices to go to BUS FREE phase.
- c. SCSI Bus Arbitration - When enabled, the normal progression is from the BUS FREE phase to ARBITRATION, from ARBITRATION to SELECTION or RESELECTION, and from SELECTION or RESELECTION to one or more of the information transfer phases (COMMAND, DATA, STATUS, or MESSAGE). When disabled, the normal progression is from BUS FREE phase to SELECTION, and from SELECTION to one or more of the information transfer phases (COMMAND, DATA, STATUS, or MESSAGE).
- d. SCSI Bus Parity Checking - When enabled, the parity of the incoming write data is checked by the STU for odd parity and an error is posted if incorrect. When disabled, the incoming parity of the data is ignored.
- e. Assume Copy Disk Block Size 512 - When enabled, the SCSI interface assumes the copy disk block size to be 512 bytes. When disabled, it reads one disk block to determine block size during Copy.
- f. Loop On RAM DATA Dump - Only during code debug.
- g. Auto Read/Write Error Recovery - When enabled, this option activates automatic read/write error recovery by the STU.

## POWER-ON DIAGNOSTICS

The SCSI interface automatically resets and performs a Power-On Health Check sequence of microdiagnostic routines each time power is applied. The results of this power-on check are displayed via the lights on the SCSI interface PWA.

### o Differential SCSI Interface

	<u>8</u>	<u>4</u>	<u>2</u>	<u>1</u>	<u>BIT VALUE</u>
Location 1T LED#	7	6	5	4	Most significant byte
Location 1S LED#	3	2	1	0	Least significant byte

### o Single-Ended SCSI Interface

	<u>8</u>	<u>4</u>	<u>2</u>	<u>1</u>	<u>BIT VALUE</u>
Location 1S LED#	7	6	5	4	Most significant byte
Location 1R LED#	3	2	1	0	Least significant byte

The power-on check takes about 8 seconds to complete. Power-up occurs in the following sequence:

<u>FUNCTION</u>	<u>ERROR CODE</u>
- Disable SCSI	
- 8085 MPU test - jump and initial command	99
- Perform PROM #1 checksum	91
- Perform PROM #2 checksum	92
- Perform PROM #3 checksum	93
- 8085 MPU test - register and memory commands	94
- Test controller RAM	95
- Set stack pointer	
- Test timer	97
- Test SCSI chip	98
- Test DMA registers	9B
- Test DMA data paths	9D
- Test data buffer	9F

An error causes execution to transfer to a common execution point. If power-up fails, the clear-power-up flag remains set, and the first SCSI function results in an error status being returned. If the power-up phase passed with no error, a 90 is written into the lights. Next, all the data structures are initialized, interrupts are enabled, and the firmware goes into the idle loop until a SCSI function is sent from the host.

#### NOTE

If a failure occurs on the SCSI interface during the power-on health check, there will be no indication of the error on the operator panel display.

#### ON-LINE DIAGNOSTICS

The SCSI interface has the ability to execute on-line diagnostic commands received from the host by the SCSI Send Diagnostic command. The diagnostics consist of routines to test the SCSI interface.

#### RESET CONDITIONS

The STU SCSI interface supports the SCSI bus HARD RESET option and, upon detecting either the SCSI bus RESET signal or BUS DEVICE RESET message, immediately terminates all operations and goes to the BUS FREE phase. No bus resets are issued by the SCSI controller. Upon detecting the SCSI bus RESET signal, the STU SCSI interface executes a limited set of power-on checks.

#### NOTE

It is the system's responsibility to protect the SCSI bus from data glitches during power-on.

Whenever the STU is put on-line, an internal soft reset is performed. A soft reset is defined as clearing all error statuses, but not resetting the SCSI bus.

#### ERROR RECOVERY

The STU SCSI interface will retry read and write media errors up to eight times before returning a MEDIA ERROR sense key. If a parity error is detected during a transfer on the SCSI bus, the transfer is retried up to three times before a HARDWARE ERROR sense key is set.

#### RESELECTION TIMEOUT PROCEDURE

The STU SCSI interface follows the reselection timeout procedure as follows:

The target continues to assert SEL and I/O and releases all DATA BUS signals. If the target has not detected BSY to be true after at least a selection abort time, plus two deskew delays, the target releases SEL and I/O allowing the SCSI bus to go to the BUS FREE phase. SCSI devices that respond to RESELECTION ensure that the RESELECTION was still valid within a selection abort time of their assertion of BSY. Failure to comply with this requirement could result in an improper reselection (two initiators connected to the same target or the wrong initiator connected to a target).

## ADDRESSING

The STU SCSI interface may reside at any of the valid SCSI ID's (Device Identifiers 0-7) on the SCSI bus. The drive resides as logical unit "0" on the SCSI interface.

## OPERATING MODE

The STU SCSI interface acts as a target on the SCSI bus for all commands except Copy. If a Copy command is received, the interface switches roles and becomes the initiator, and then initiates the necessary commands to the direct access peripheral. When the command is complete, the interface switches back to the target role and transfers status back to the controller that originated the Copy command.

## PERFORMANCE

The STU SCSI interface attempts to minimize the time that it requires the SCSI bus. If a Read command is received and data is not available, the interface disconnects and obtains the requested data, then reconnects and transfers the data. If a Write command is received and space is not available in the buffer, the interface disconnects and reconnects when buffer space is available.

If a data transfer is greater than 16K, the STU SCSI interface breaks the transfer into two or more individual SCSI bus transfer requests with a transfer size of approximately 16K bytes for each connection of the SCSI bus. This transfer size was chosen to provide enough data in the buffer to keep the tape streaming and to free up the SCSI bus as much as possible.

The maximum transfer rate on the SCSI bus is 1.25M (mega) bytes per second to a distance of 6 meters when using single-ended drivers. When using differential drivers, the maximum transfer rate is 1.25M bytes per second to a distance of 10 meters with linear degradation to 0.9M bytes per second at 25 meters.

## SCSI MESSAGES

The following SCSI messages are supported by the SCSI interface:

- 00 - Command Complete
- 02 - Save Data Pointer
- 03 - Restore Pointers
- 04 - Disconnect
- 05 - Initiator Detected Error
- 06 - Abort
- 07 - Message Reject
- 08 - No Operation
- 09 - Message Parity Error
- 0C - Bus Device Reset
- 80-FF Identify

Extended messages cause a message reject.

## SCSI STATUS

One status byte of data is transmitted in the target mode (received in the initiator mode). When a Copy function involves another peripheral, the status byte is received from the peripheral and then any sense data is collected. The STU SCSI interface changes to the target role and transfers the status byte to its initiator. The following status byte codes are supported:

<u>BIT</u> <u>4</u>	<u>BIT</u> <u>3</u>	<u>BIT</u> <u>2</u>	<u>BIT</u> <u>1</u>	<u>MEANING</u>
0	0	0	0	Good
0	0	0	1	Check Condition
0	1	0	0	Busy
1	0	0	0	Intermediate Good
1	1	0	0	Reservation Conflict

## QUEING OF HOST REQUESTS

Two I/O Command Blocks (IOCB) exist in the firmware so that two SCSI functions can be executing in an interleaved fashion, if only one is a "tape movement" function. Commands which are executed while a Tape Movement command is in progress are: Request Sense, Read Block Limits, Inquiry, and Test Unit Ready. If no IOCBs are available, the host identification is stored. When an IOCB becomes available, the host is reselected and the function data is received from the host. If, upon obtaining an IOCB, a Tape Motion command is in process via the other IOCB, a BUSY status is returned to the host.



## Command Set

The commands accepted by the STU interface in the target mode are as follows:

00	Test Unit Ready
01	Rewind
03	Request Sense
05	Read Block Limits
08	Read
0A	Write
0F	Read Reverse
10	Write File Mark
* 11	Space
12	Inquiry
* 13	Verify
14	Recover Buffered Data
15	Mode Select
16	Reserve Unit
17	Release Unit
18	Copy
19	Erase
1A	Mode Sense
1B	Load/Unload
1C	Receive Diagnostic Results
1D	Send Diagnostics
3B	Write Data Buffer
3C	Read Data Buffer

In the initiator (Copy) mode, the STU SCSI interface can issue the following commands:

03	Request Sense
08	Read
0A	Write

\* Supports a limited version of this command (see SPACE and VERIFY commands).

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

TEST UNIT READY (00)	<p>Returns the status of the STU. A status of GOOD is returned if the STU is loaded and on-line.</p> <p>The extended sense data contains a sense key of 02 (Not Ready) if the STU is not loaded and online. Additional sense data contains the status bytes of the STU.</p>
-------------------------------	---

REWIND (01)	<p>Causes the STU to rewind to BOT. When the command is received, the status of the STU is checked and errors such as Busy, Not Ready, or Unit Attention are immediately reported.</p>
----------------	--

A disconnect from the SCSI bus is issued and the level of data in the buffer is checked. If the buffer contains data from a previous Write command, a Write command is issued to the tape drive and all data in the buffer is written to tape before the drive is issued the Rewind command. If the buffer contains data from a previous Read command, the buffer is cleared.

After the Rewind command is issued to the drive, the immediate bit of the Command Descriptor Block (CDB) (bit 8 of byte 1) is tested. If this bit is set, a GOOD status is returned immediately after issuing the command. If this immediate bit is not set, the following occurs: an approximate 4 minute gross timer is started.

At the completion of the Rewind function, the status of the drive is again checked. The host is reselected and the appropriate status returned.

If the gross time is exhausted before completion of the Rewind function, a CHECK CONDITION status is returned. A HARDWARE ERROR sense key is 'set', plus the tape drive status bytes.

REQUEST SENSE (03)	<p>Returns status information to the host for the last check condition issued to the initiator.</p>
--------------------------	---

The sense data returned uses the SCSI extended sense format and additional sense information.

Anytime a CHECK CONDITION is returned, the sense data is saved in the STU SCSI interface. It is not released until the host, which received the CHECK CONDITION status, performs the Request Sense command or until it issues another command.

COMMANDFUNCTION

READ  
BLOCK  
LIMITS  
(05)

Returns the maximum and minimum data block lengths supported.

A value of 1 is returned for the minimum block length, and a value of 64K (10000 hex) is returned for the maximum block length.

The following six bytes are returned:

<u>Byte</u>	<u>Data</u>	<u>Meaning</u>
0	00	Reserved
1	01	Maximum Block Length (MSB)
2	00	Maximum Block Length
3	00	Maximum Block Length (LSB)
4	00	Minimum Block Length (MSB)
5	01	Minimum Block Length (LSB)

READ  
(08)

Transfers data from the STU to the initiator of the Read command.

When the STU SCSI interface initially receives the Read command, the status of the tape drive is checked. If an error condition exists such as Busy, Not Ready or Unit Attention, or if a Read command is issued directly after the Write command, a CHECK CONDITION is issued with the specific error data reported in the extended sense field.

The STU SCSI interface supports both fixed and variable length block sizes. When the unit is in variable mode, a Read command with the fixed bit set (bit 0, byte 1 of CDB) is rejected with an ILLEGAL REQUEST sense key. This status is returned also for a Read command with the fixed bit off when the unit is in the fixed block mode.

The amount of data to read is located in bytes 2 thru 4 of the CDB. If the mode is fixed, this field contains the number of blocks to read. Otherwise, it contains the length in bytes of the next block to read. If the actual block size does not equal the specified block size, an ILLEGAL REQUEST status is returned. Only the number of bytes equal to the smaller size will be transferred to the host. The residue count in the extended sense fields contains the requested size minus the actual size if the mode is variable, or the number of blocks remaining to be read if the mode is fixed.

COMMANDFUNCTION

READ  
(Cont'd)

If a Read command is received with a byte or block count of zero, the command is treated as no operation, with a GOOD status returned immediately. No data transfers are executed and no tape motion is started.

If the unit is in the fixed block mode, the requested number of data blocks to be read is grouped into individual SCSI data transfers. The size of each transfer depends on the tape block size. The fewest number of blocks, which total at least 16K bytes, is transferred one at a time. If there is less than 16K bytes remaining to be read, the remaining amount is transferred.

Each SCSI data transfer uses the following process to read the requested data blocks from tape.

Data buffer level is checked to see if it contains enough data to satisfy the individual data transfer request. If enough data is available in the buffer, the transfer from buffer to host is made. If buffer is either empty or does not contain enough data for individual transfer request, the host is disconnected from the SCSI bus and a Read command is issued to the tape drive. When enough data is available for the transfer request, the host is reselected and the requested data is transferred from buffer to host.

If the requested amount of data to be read is greater than amount of available buffer, the above process is repeated until all requested data is transferred to the host. If all data was successfully transferred and no errors detected, a GOOD status is returned to the host which terminates the Read command.

Once the tape is started in the read mode, only:  
(1) a double file mark being read (or a single file mark if tape is positioned past EOT marker), (2) the data buffer becoming full, or (3) a hard error will stop the reading from tape and stop tape motion.

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

READ  
(Cont'd)

If the data file on tape contains more data blocks than requested by the Read command, the data transfer to the buffer and tape motion continue until one of the above conditions stops the tape.

If the requested block count equals the remaining block count in the file, all data is transferred and no file mark indication is given, although the tape drive has read and positioned the tape behind the file mark. On the next Read command issued to the STU SCSI interface, the FILE MARK status and residue count is indicated due to the buffer being empty and the file mark passed.

If a HARD ERROR status is returned from the drive and the STU SCSI interface is in Auto Error Recovery mode (switch selectable), the STU SCSI interface will backspace the tape and try to read the block again. It will retry eight times before it returns a MEDIA ERROR sense key. The extended sense data includes a residue count, drive status bytes, and a retry count which indicates the total number of retries that have occurred since the last file mark encountered or since load point. The residue count specifies the number of blocks (fixed) or bytes (variable) which were not read.

A BLANK CHECK sense key is also returned if no data is detected on the tape. The STU SCSI interface reads the extended sense data after a hard error is reported from the drive. If the read timeout bit is set, then a BLANK CHECK is returned.

When a file mark is detected before a Read command is completed, a CHECK CONDITION status is sent. The extended sense data contains the following: a FILE MARK status, residue count, and drive sense bytes. A RECOVERABLE ERROR sense key is also returned in the sense data if any retries have occurred since the last file mark encountered or since load point. The number of retries that occurred is included.

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

READ  
(Cont'd)

A HARDWARE ERROR sense key, along with a secondary error code of "43", indicates that a buffer parity error occurred at some time in the last command. No recovery is possible with this condition except for the host to back up the tape to the start of the first block transferred on the Read command. The number of blocks to back up can be calculated by subtracting the residue from the original number of blocks to read if it is in fixed block mode, or is equal to "1" if it is in variable block mode.

If the STU Auto Read/Write Error Recovery is not enabled whenever a hard error is returned from the drive, a MEDIA ERROR sense key is returned to the host along with extended sense data containing the residual count, drive sense bytes, and a retry count which indicates the number of retries that have occurred since the last file mark was encountered or since load point. The residual count specifies the number of blocks (fixed) or bytes (variable) which were not read.

WRITE  
(0A)

The Write command transfers data from the initiator to the STU.

When the STU SCSI interface initially receives the command, the status of the tape drive is checked. If an error condition exists such as Busy, Not Ready, Unit Attention or Write, a CHECK CONDITION is sent with the specific error data reported in the extended sense field.

The STU SCSI interface supports both the fixed and variable length block sizes. When the unit is in the variable block mode, a Write command with fixed bit set (bit 0, byte 1 of CDB) will be rejected with an ILLEGAL REQUEST sense key. This status is returned also for a Write command with the fixed bit off when the unit is in fixed block mode.

The amount of data to write is located in bytes 2 thru 4 of the CDB. If the mode is fixed, the field contains the number of blocks to write, otherwise, it contains the length in bytes of next block to write.

COMMANDFUNCTION

WRITE  
(Cont'd)

If a Write command is received with a byte or block count of zero, the command is treated as no operation with a COMPLETE status returned immediately. No data transfers are executed and no tape motion started.

If the unit is in the variable block mode, the byte count must not be greater than 64K. When the count is too large, the command is rejected with an ILLEGAL REQUEST sense key.

If the unit is in the fixed block mode, the requested number of data blocks to write is grouped into individual SCSI data transfers. The size of each transfer depends on the tape block size. The fewest number of blocks which total at least 16K bytes is transferred one at a time. If there is less than 16K bytes remaining to be written, the remaining amount is transferred.

If the buffer contains data from a previous Read command, the buffer is cleared and the tape is positioned after the last block sent to the host.

Each SCSI data transfer uses the following process to write the requested data blocks to tape.

The buffer data level is checked to see if it will hold all data specified in the individual transfer request. If the buffer is empty or has enough room for the data, the transfer from host to buffer is made. If the buffer does not have enough room for the requested transfer, the host is disconnected from the SCSI bus and a Write command is issued to the tape drive. When enough room is available in the buffer for data transfer, the host is reselected and the requested data is transferred from host to buffer.

If the requested amount of data to write is greater than the amount of available buffer, the above process is repeated until all data is successfully transferred to the buffer.

When the buffer contains 16K bytes or more of data, it starts write mode. Once tape is started in write mode, it writes all data contained in the buffer. If the buffer becomes empty and no additional SCSI Write commands are issued, the tape drive performs the under-run sequence and stops tape motion.

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

WRITE  
(Cont'd)

In the buffered write mode, if data from one or more Write commands does not fill the buffer with at least 16K bytes of data, a Tape Write command is not issued to the drive and no data is transferred to the tape. To complete the data transfer to tape and the write sequence, a SCSI Write File Mark command is issued.

In the unbuffered mode, all data transferred to the buffer is also transferred to the tape drive before a GOOD status is sent to the host. If requested data did not fill the buffer, the host is disconnected from the SCSI bus and a Write command issued to the tape drive. When the buffer becomes empty, the host is reselected and a GOOD status sent. After each SCSI Write command, the tape drive performs a write under-run sequence.

The only difference between buffered and unbuffered operations is the unbuffered mode does not terminate the operation until the data is written to the tape.

If the AUTO ERROR RECOVERY switch is set, the STU SCSI interface, upon detecting a hard error condition on the tape, backspaces, erases the length of the record and rewrites the record. This sequence is repeated up to eight times before a MEDIA ERROR sense key is returned. When the MEDIA ERROR sense key is returned, the extended sense data includes a residual count, drive sense bytes, and a retry count which indicates the number of retries that have occurred since the last file mark or since load point. The residual count consists of all blocks (fixed) or bytes (variable) in the buffer, plus those not yet transferred to the buffer. Recoverable write errors are not reported until a file mark is written.



<u>COMMAND</u>	<u>FUNCTION</u>
WRITE (Cont'd)	<p>If the AUTO ERROR RECOVERY switch is not set, the STU SCSI interface returns a MEDIA ERROR sense key whenever a write error is returned from the drive. The extended sense data contains the drive sense data and a residual count indicating the number of blocks (fixed) or bytes (variable) in the buffer, plus those not yet transferred to the buffer. It is the host's responsibility to perform error recovery. As part of the error recovery procedure, the host must recover, via the Recover Buffer Data command, any data written to the buffer, but not yet transferred to tape, including the record in error. This action must be taken PRIOR to issuing any other tape motion commands (i.e., backspace, erase). Failure to do this causes all data remaining in the buffer to be written to tape, leaving the record in error on the tape.</p> <p>When the physical EOT marker is detected, upon writing the current buffered data to tape, the EOM (End-of-Media) bit is set in the extended sense with no sense key. The residual count consists of those blocks requested by the Write command, but not yet transferred to the buffer. Commands issued after physical EOT has been detected continue to be processed in the unbuffered mode.</p>
READ REVERSE (OF)	<p>Transfers data from the STU to the initiator that issued the command.</p> <p>When the STU SCSI interface initially receives the command, the status of the tape drive is checked. If an error condition exists such as Busy, Not Ready or Unit Attention, a CHECK CONDITION is issued with the specific error reported in the extended sense field.</p> <p>The buffer is checked before the Read Reverse command is issued. If it contains data from the previous Read Forward command, the buffer is cleared and tape is repositioned. If it contains data from a previous Write command, the data is written to the tape.</p> <p>The Read Reverse command causes the STU SCSI interface to perform the same function as described in the Read command except that tape motion is in the reverse direction. Thus, the blocks and the bytes within the blocks are transferred into the buffer in reverse order.</p>

COMMANDFUNCTION

WRITE  
FILE  
MARK  
(10)

Completes any Write command in process and/or writes one or more file marks to tape.

When the STU SCSI interface receives this command, the status of the tape drive is checked. If an error condition exists such as Busy, Not Ready or Unit Attention, a CHECK CONDITION is issued with specific error data reported in the extended sense field.

If none of the above errors exist, the buffer is checked. If the buffer contains data from a previous Read command, the buffer is cleared and the tape is repositioned.

If the immediate bit is not set, or if the immediate bit is set and two more file marks are being requested to be written sequentially on the tape, the host is disconnected and any data residing in the buffer from previous Write commands is written to tape. The host is reselected and returned a GOOD status, providing all buffered data blocks and file marks (if any) were correctly written to tape.

If the immediate bit is set and the requested number of file marks to be written is zero, the command is treated as a no operation with a GOOD status returned immediately.

If the immediate bit is set and a single file mark is to be written to tape, and the previous command was not a Write File Mark, the host is returned a GOOD status immediately and the file mark is entered into the buffer.

A RECOVERABLE ERROR sense key is reported along with tape status if any blocks following the previous file mark or load point were rewritten. Extended sense data includes the number of retries that occurred.

When the physical EOT marker is detected, the EOM status is returned. The residual count contains the number of file marks requested, but not yet written to tape. If the tape is already positioned after the physical EOT before a File Mark command is issued, all file marks are written and an EOM status is returned with no residual count reported.

<u>COMMAND</u>	<u>FUNCTION</u>
SPACE (11)	<p>Provides a means of positioning the tape to a specific data block; the data block following a specific file mark or series of sequential file marks.</p> <p>The STU SCSI interface accepts a Space commands which position tape in either the forward or reverse direction. It supports spacing blocks, file marks and sequential file marks, but does not support spacing to physical End-of-Data.</p> <p>When the STU SCSI interface receives a Space command, the status of the tape drive is checked. If an error condition exists such as Busy, Not Ready or Unit Attention, a CHECK CONDITION is issued with specific error data reported in the extended sense field.</p> <p>The code bits and count bytes in the CDB determine the operations to be performed by the STU SCSI interface. If the Space command is received with a count of zero, the command is treated as a no operation with a GOOD status returned immediately.</p> <p>If the buffer contains data from a read, it backspaces the tape so that tape is positioned after the last block transferred to the host. Otherwise, it writes the data out to tape. If an error is encountered and the buffer cannot be cleared, an ABORTED COMMAND sense key is returned.</p> <p>A SPACE BLOCK code causes the STU SCSI interface to empty the buffer and reposition the tape. It then issues commands to space the requested number of blocks. No data is transferred. If a file mark is encountered, a FILE MARK status is returned with a residue containing the number of blocks left to space. This residue is also returned with an END-OF-MEDIA status if a Space Reverse command is issued when the tape is at load point.</p> <p>A SPACE FILE MARK code instructs the STU SCSI interface to issue instructions to the tape drive until a file mark is encountered. No data is transferred to the buffer. The count bytes determine the number of file marks to space.</p>

COMMANDFUNCTION

SPACE  
(Cont'd)

A SEQUENTIAL FILE MARK code instructs the STU SCSI interface to issue the following sequence of instructions to determine the requested number of sequential file marks. First, Read instructions are issued to the tape drive to locate the first file mark. Next, another Read instruction is issued. If a file mark is not indicated from the Read instruction, then this is not a sequential file mark and the search for the next file mark is repeated. If a file mark is indicated, then additional Read instructions are issued until the sequential file mark count is satisfied.

A Space command will not return a media error if it spaces over a bad block on a tape. It returns this error only if it encounters blank tape.

A RECOVERABLE ERROR sense key is returned when a file mark is encountered, if any retries have occurred since the last file mark encountered or load point. The number of retries that occurred is included.

INQUIRY  
(12)

Causes the interface to assemble 36 bytes of data to identify the STU SCSI. Following data is returned:

<u>Byte</u>	<u>Length</u>	<u>Value</u>	<u>Meaning</u>
0	1	01	Device Type (sequential access device)
	1	7F	Device Type (logical unit not present)
1	1	80	RMB, Device Type Qualifier
2	1	00	Revision Level
3	1	01	Response Data Format
4	1	1F	Additional Length
5	3	00	Reserved
8	1	43	ASCII "C"
9	1	44	ASCII "D"
10	1	43	ASCII "C"
11	5	20	Five ASCII Blanks
16	16	*	Product Identification
32	4	**	Product Revision Number

\* Product Identification

ASCII 92181 for 25/100 - 1600 BPI Unit

\*\* Product Revision Number

4 ASCII bytes containing hardware/software revision level

COMMANDFUNCTION

VERIFY  
(13)

Performs a media check of the data blocks on the tape. No data transfer occurs to the SCSI bus.

The STU SCSI interface does not support the byte compare mode (bit 1, byte 1 of CDB).

The STU SCSI interface supports both fixed and variable length block sizes. When the unit is in the variable block mode, a Verify command with the fixed bit set (bit 0, byte 1 of CDB) is rejected with an ILLEGAL REQUEST sense key. This status is also returned for a Verify command with the fixed bit off when the unit is in the fixed block mode.

When the STU SCSI interface receives the Verify command, the status of the tape drive is checked. If an error condition exists such as Busy, Not Ready or Unit Attention, a CHECK CONDITION is issued with the specific error data reported in extended sense field.

The Verify command causes the STU SCSI interface to perform the same function as described in the Read command except that no data is transferred from the data buffer to the host. The data is read from tape and transferred into the buffer. The number of data blocks or bytes requested in the Verify command is cleared out of the buffer. When the verify block count is satisfied, the command is reported as described in the Read command.

RECOVER  
BUFFERED  
DATA  
(14)

Allows recovery of data which was written to the data buffer, but not transferred to tape. The STU SCSI interface supports both fixed and variable length block sizes. When the unit is in the variable block mode, a Recover Buffered Data command with the fixed bit set (bit 0, byte 1 of CDB) is rejected with an ILLEGAL REQUEST sense key. This status is also returned for a Recover Buffered Data command with the fixed bit off when the unit is in fixed block mode.

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

RECOVER  
BUFFERED  
DATA  
(Cont'd)

The amount of data to recover is located in bytes 2 thru 4 of the CDB. If the mode is fixed, this field contains the number of blocks to recover. Otherwise, it contains the length in bytes of the next block to recover. If the actual block size does not equal the specified block size, an ILLEGAL LENGTH status is returned. Only the number of bytes equal to the smaller size is transferred to the host. The residue count in the extended sense fields contains the requested size minus the actual size if the mode is variable, or the number of blocks which were requested but not transferred if the mode was fixed.

A Recover Buffered Data command received with a byte or block count of zero is treated as no operation with a COMPLETE status returned.

All data blocks requested are transferred from the buffer to the host in one data transfer connection. All errors or differences between the requested number of blocks and actual data buffer contents result in a GOOD status with the check bit set. The extended sense data identifies the condition which created the CHECK CONDITION status.

The HARDWARE ERROR sense key is sent if a parity error occurred in the data buffer.

An END-OF-MEDIA status is sent if the requested byte or block count is greater than the available data in the buffer. Available data is transferred to host. A residue count is included in the sense data field.

A FILE MARK status is returned if a file mark is recovered from the buffer.

MODE  
SELECT  
(15)

(Mode Select pages are not supported) Allows the initiator to specify media, unit, and device parameters. A Mode Select command issued with an incorrect Block Descriptor List will be rejected with an ILLEGAL REQUEST sense key.

The STU SCSI interface supports both the buffered and unbuffered mode of writing data to tape, and it supports both fixed length and variable length block sizes. It also supports two speeds: high speed and low speed.

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

MODE SELECT (Cont'd)	In the buffered mode, the STU SCSI interface will report a GOOD status on Write commands as soon as all data has been transferred to the interface buffer. One or more blocks of data may be buffered prior to writing the blocks to tape.
----------------------------	--

In unbuffered mode, all data for the Write command is written to tape prior to reporting a GOOD status.

The default values for this interface are buffered mode, high speed, 1600 bpi density, and fixed length block sizes of 512 bytes. These values are selected at power-up and after a Reset is issued to the STU SCSI interface.

The following is the supported parameter list:

<u>Byte</u>	<u>Value</u>	<u>Meaning</u>
0	00	Reserved
1	00	Reserved
2	XY	X=1 - Buffered Mode X=0 - Unbuffered Mode Y=1 - Low Speed Y=0 or 2 - High Speed
3	08	Length of Block Descriptor List (bytes)

#### BLOCK DESCRIPTOR LIST

<u>Byte</u>	<u>Value</u>	<u>Meaning</u>
0	XX	Density Code 00 or 02 = 1600 BPI PE
1	00	Number of Blocks (MSB)
2	00	Number of Blocks
3	00	Number of Blocks (LSB)
4	00	Reserved
5	XX	Block Size (MSB)
6	XX	Block Size
7	XX	Block Size (LSB)

The block size specifies the length in bytes of each logical block described by the block descriptor. A block size of zero indicates that the length shall be variable.

<u>COMMAND</u>	<u>FUNCTION</u>
RESEKVE UNIT (16)	Used to reserve the STU. Once reserved, all other initiators are blocked from using the STU. Only non-tape commands (Test Unit Ready, Inquiry, etc.) are executed while a Reserve Unit command is in effect. Any attempt to reserve/access a unit already reserved returns a RESERVED status byte. If the STU is reserved by an initiator attempting a second Reserve, a GOOD status is returned. The initiator is responsible for releasing the unit when there is no longer a need for exclusive use of the STU. The third-party reservation option is supported.
RELEASE UNIT (17)	Releases the STU after it has been reserved by the Reserve Unit command. A release issued to an unreserved STU returns a function complete.
COPY (18)	<p>Allows a host computer to direct the STU SCSI interface to copy data to or from another direct access device attached to the SCSI bus. Third party transfers are not supported.</p> <p>Initially, an initiator selects the STU and, acting as a target, the SCSI function is transferred into the STU SCSI interface memory if execution space is available. If another Copy is in progress, or any tape movement function is currently active, a BUSY status is returned to the host. If there are no initial errors on the command transfer (parity error on the SCSI link, invalid command code, or invalid logical unit number), the data block definition is brought across the link. The STU SCSI interface allows direct access to sequential and visa versa. The code and functions are:</p> <p>00 Block (*) Read from disk to tape 08 Block (*) Write to disk from tape</p> <p>(*) The disk data block size is determined by the STU SCSI interface issuing a read one block to the specific disk unit.</p>



<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

COPY  
(Cont'd)

Once the data block is read and it is verified that the COPY function is valid, the first segment descriptor is received from the initiator. This data is verified for errors (invalid source or destination I.D., invalid source or destination Logical Unit Number (LUN), tape block size equal to zero or greater than 48K, invalid number of blocks for disk, or invalid starting address for disk).

After the data for the segment is in the buffer, the STU SCSI interface disconnects from the initiator and switches to an initiator role to begin the data transfer. A SCSI command descriptor block is selected based on a Copy function, the correct target is selected, and the command is transferred to the target disk. An internal 250 millisecond timer is started, and if the timer expires, Busy is returned from the target. If a SCSI error occurs on the transfer, the Copy function is terminated with a CHECK CONDITION status.

When the target accepts the command and begins to transfer data, the following sequence of events occurs.

Copy disk to tape:

- The Read function is sent to the disk for a 16K (or less) block of data.
- Hardware data path from SCSI to buffered STU interface is set up.
- The block of data is transferred into buffer area.
- The buffer to tape hardware data path is set up.
- The following loop is executed until segment data transfer is complete.

Transfer buffer data to tape (always moving).  
Send 16K read to disk.  
Transfer data into buffer.

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

COPY  
(Cont'd)

Copy tape to disk:

- The Write function is sent to the disk for a 16K (or less) block of data.
- Hardware data path from tape to buffer is set up.
- Start data transfer from tape to buffer.
- The following loop is executed until segment data transfer is complete.

Transfer tape data to buffer (always moving).  
Transfer data to disk (16K).  
Send a 16K Write command to disk.

ERASE  
(19)

Erases part or all of the remaining tape beginning from the current tape position.

A command received without the long bit set (bit 0, byte 1 of CDB) erases a fixed length of approximately 3 inches of tape. A command received with the long bit set erases the remainder of the tape to a point 10 feet past the physical end of the tape marker and rewinds the tape.

When the Erase command is received, the status of the tape drive is checked and error conditions such as Busy, Not Ready, Unit Attention, or Write Protected are reported immediately.

Next, the host is disconnected from the SCSI bus and the level of data in the buffer is checked. If the buffer contains data from a previous Read command, the buffer is cleared and the tape repositioned. If the buffer contains data from a previous Write command, the data is written to tape.

The STU SCSI interface then issues the Erase function to the drive. At the completion of the function, the status of the drive is checked. The host is reselected and the appropriate status returned.

<u>COMMAND</u>	<u>FUNCTION</u>
----------------	-----------------

ERASE (Cont'd)	If the END-OF-MEDIA is encountered on the Erase and the long bit is not set, the END-OF-MEDIA status is returned.
-------------------	---

If the END-OF-MEDIA is encountered on the Write, all data remaining in the buffer will be written to the tape. An END-OF-MEDIA status will be reported along with a residue of "1" indicating that Erase was not performed.

MODE SENSE (1A)	(Mode Sense pages are not supported) Provides a means for the STU SCSI interface to report its media and device parameters.
-----------------------	---

The following mode sense data is transferred to the host:

<u>Byte</u>	<u>Value</u>	<u>Meaning</u>
0	0C	Length of following data
1	00	Media Type
2 Bit 7	X	X=1 - Unit Write Protected X=0 - Unit Write Enabled
Bit 4-6	Y	Y=1 - Buffered Mode Y=0 - Unbuffered Mode
Bit 0-3	Z	Z=0 - Default Speed Z=1 - Low Speed Z=2 - High Speed
3	08	Length of Block Descriptor List

#### BLOCK DESCRIPTOR LIST

<u>Byte</u>	<u>Value</u>	<u>Meaning</u>
0	XX	Density Code 00 or 02 = 1600 BPI PE
1	00	Number of Blocks (MSB)
2	00	Number of Blocks
3	00	Number of Blocks (LSB)
4	00	Reserved
5	XX	Block Size (MSB)
6	XX	Block Size
7	XX	Block Size (LSB)

COMMANDFUNCTION

LOAD/  
UNLOAD  
(1B)

Designed to position the media at load point or to position it for removal from the drive.

When the command is received, the status of the drive is checked and errors such as Busy, Not Ready or Unit Attention are immediately reported.

If either the Load or Retension bit is set (bits 8 and 1 of byte 4 in CDB), the command is treated as a standard Tape Rewind command.

If the Load and Retension bits are zero (Unload function), the tape is set off-line and rewind completely off the take-up reel.

After the command is received, a disconnect from the SCSI bus is issued. If the buffer contains data from a previous command, the buffer is emptied and the tape repositioned. The Rewind function is then issued to the drive and the immediate bit is checked (bit 0, byte 1 of CDB). If the bit is set, a GOOD status is returned immediately. If the bit is not set, the host is reselected at the completion of the Rewind function.

RECEIVE  
DIAGNOSTIC  
RESULTS  
(1C)

Causes the STU SCSI interface to return the results of the diagnostic commands received from the Send Diagnostic command.

The Receive Diagnostic command data field is defined as follows:

<u>Byte</u>	<u>Length</u>	<u>Identification</u>
0	1	Valid Data Flag, non-zero-invalid
1	1	Reserved
2	2	Number of data bytes (from Test Buffer function)
4	N	Data Field
4+N	1	Number of bytes in sense field
4+N+1	M	Extended sense data field

COMMANDFUNCTION

SEND  
DIAGNOSTIC  
(1D)

Causes the STU SCSI interface to execute the diagnostic specified by the parameter list.

Individual interface and STU diagnostics may be run by specifying the numbers in the Send Diagnostic command data file. The format of this file is shown below.

<u>Byte</u>	<u>Length</u>	<u>Identification</u>
0	2	Diagnostic File Length
2	1	Reserved
3	1	Interface Diagnostic Function Code (see following table)
4	2	Zero Filled
6	2	Block Offset (0-7FH)
8	2	Number of bytes in data field
10	N	Data Field For Interface Test Buffer Function [if interface diagnostic function code = (D1)]

The following interface diagnostic function codes are supported:

<u>Code</u>	<u>Function</u>
D0	Diagnostic Inquiry
D1	Test Buffer

COMMANDFUNCTION

SEND  
DIAGNOSTIC  
(Cont'd)

Diagnostic Inquiry (D0) - Returns 64 bytes of information about the STU SCSI interface, and this data is returned in the data field of the Receive Diagnostic file.

Since the controller only supports the Test Buffer function, only the first 2 bytes contain valid data - a value of 64K-1 (FFFFH) - all other fields are zero filled since they are not used on the tape controller.

Test Buffer (D1) - Allows testing of the data buffer. The logic block offset value is supported. This value is multiplied by the mode selected block size to obtain the byte offset into the buffer. On a Send Diagnostic command, the data is transferred from the buffer to the host.

The Test Buffer command may be issued only when the data buffer is empty unless the device and/or unit off-line bits are set (bits 0 and 1 of byte 1 in CDB). If either of the bits are set, the data in the buffer is destroyed.

An ILLEGAL REQUEST status is returned if the self-test bit is set (bit 2 of byte 2 of the CDB).

COMMANDFUNCTION

WRITE DATA  
BUFFER  
(3B)

Used in conjunction with the Read Data Buffer command to provide a means for testing the STU interface data buffer and SCSI bus integrity.

When the command is received, the STU status is checked and errors such as Busy or Unit Attention are reported immediately. The buffer is then checked, and if it contains data from a previous Write command, the data is written to tape. If the buffer contains data from a previous Read command, the buffer is cleared and the tape repositioned.

The number of data bytes to be written into the buffer is contained in bytes 7 and 8 of CDB. Up to 65,535 data bytes may be transferred including 4 bytes of header, and up to 65,531 bytes of write buffer data. The STU SCSI interface always treats this command in the variable block mode.

If a Write Data Buffer command is received with a byte count of zero, the command is treated as no operation with a COMPLETE status reported immediately.

If the vendor unique bit is set (bit 0, byte 1 of CDB), then bytes 2 thru 5 will be used to specify the starting address in the buffer for the transfer. If the vendor unique bit is not set, then the buffer starting address is always zero.

READ DATA  
BUFFER  
(3C)

Used in conjunction with the Write Data Buffer command to provide a means for testing the STU SCSI interface data buffer and SCSI bus integrity.

When the command is received, the STU status is checked and errors such as Busy or Unit Attention are reported immediately. It is recommended that the initiator issue a Reserve Unit prior to the Write Data Buffer command and issue a Release Unit after the Read Data Buffer command.

The number of data bytes to be read from the buffer is contained in bytes 7 and 8 of the CDB. The STU SCSI interface terminates the data transfer when either the amount of data requested in the CDB has been transferred or when all available data has been transferred, whichever is less. The actual number of bytes transferred is indicated in bytes 2 and 3 of the read buffer header.

COMMANDFUNCTION

READ DATA  
BUFFER  
(Cont'd)

Up to 65,535 bytes of data (including 4-byte header) may be requested to be transferred in the CDB. If a Read Data Buffer command is received with a byte count of zero, the command is treated as a no operation with a COMPLETE status returned immediately.

If the vendor unique bit is set (bit 0, byte 1 of CDB), then bytes 2 thru 5 are used to specify the starting address in the buffer for the transfer. If the vendor unique bit is not set, then the buffer starting address is always zero.

The format of the data returned is shown below.

<u>Byte</u>	<u>Value</u>	<u>Meaning</u>
0	00	Reserved
1	00	Reserved
2	NN	Available data bytes (MSB)
3	NN	Available data bytes (LSB)
4	Y	Buffer data bytes

NOTE: If a Read Data Buffer command is issued to any area of the buffer that has not previously been written, buffer parity errors may result.

ELECTRICAL AND MECHANICAL INTERFACE

## SCSI CONNECTOR SIGNAL ASSIGNMENTS

To facilitate daisy-chaining, two 50-pin connectors are provided to connect the STU SCSI interface to the SCSI bus (Figure 1-1). Shielded Connector Alternative 1 uses AMP Inc. "MODU" series connector with a shield for this option. Connector AMP #1-499977-0 and ground plane AMP #102793-4 are provided with the Alternative 1 option. Shielded Connector Alternative 2 uses AMP Inc. "CHAMP" series connector. Connector AMP #553646-1 is provided with Alternative 2 (Figure 1-1). The strip clamp on the I/O cable bracket assembly may be used to ground the shield if a shielded ribbon cable is used, or as a means of additional strain relief.

A third option available is the I/O cable bracket assembly with no additional connectors provided for daisy-chaining. A suggested routing of the customer supplied I/O cable is shown in figure 1-2.



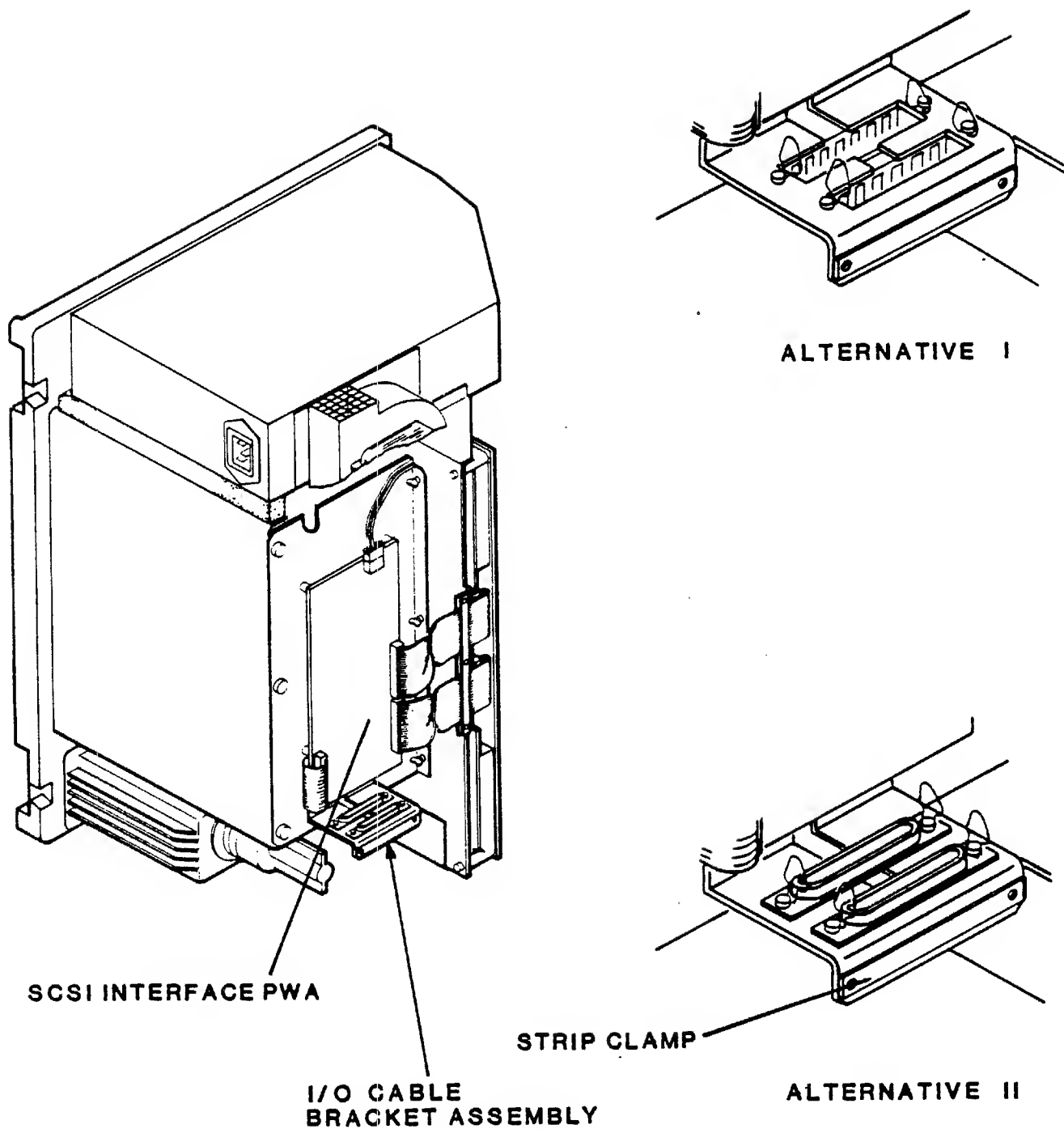


Figure 1-1. SCSI Interface With Connectors

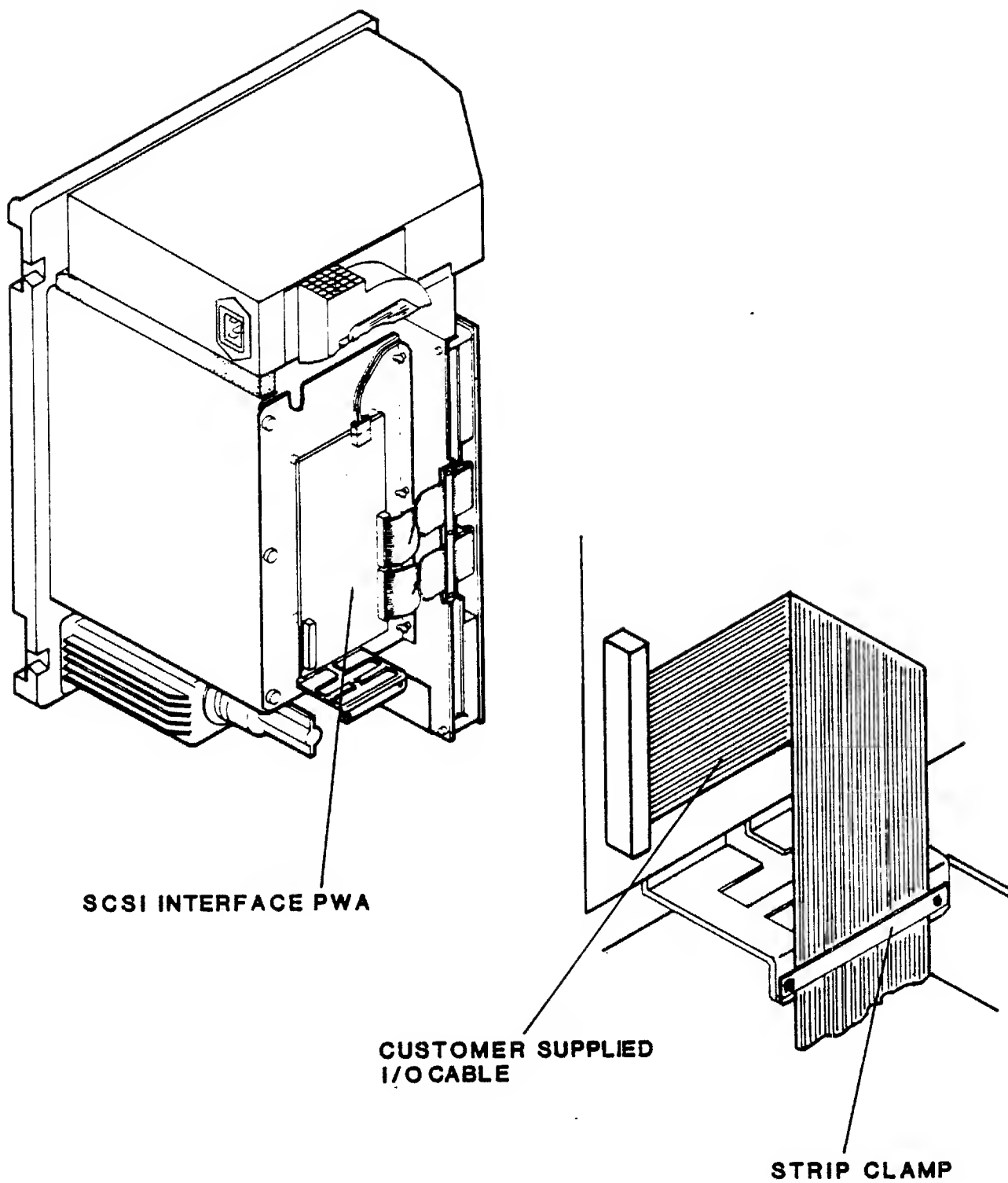


Figure 1-2. SCSI Interface Without Connectors

## Single-Ended Cable Pin Assignments

### ALTERNATIVE 1 CONNECTOR

<u>Signal</u>	<u>Pin Number</u>
-DB(0)	2
-DB(1)	4
-DB(2)	6
-DB(3)	8
-DB(4)	10
-DB(5)	12
-DB(6)	14
-DB(7)	16
-DB(P)	18
GROUND	20
GROUND	22
GROUND	24
TERMPWR	26
GROUND	28
GROUND	30
-ATN	32
GROUND	34
-BSY	36
-ACK	38
-RST	40
-MSG	42
-SEL	44
-C/D	46
-REQ	48
-I/O	50

#### NOTES:

1. All odd pins except pin 25 shall be connected to ground. Pin 25 should be left open. Some products designed prior to the generation of this standard connected this pin to ground.
2. The minus sign next to the signals indicates active low.
3. Pin 26 is reserved for providing optional terminator power (+5 volts).

## Single-Ended Cable Pin Assignments

### ALTERNATIVE 2 CONNECTOR

<u>Signal</u>	<u>Pin Number</u>
-DB(0)	26
-DB(1)	27
-DB(2)	28
-DB(3)	29
-DB(4)	30
-DB(5)	31
-DB(6)	32
-DB(7)	33
-DB(8)	34
GROUND	35
GROUND	36
GROUND	37
TERMPWR	38
GROUND	39
GROUND	40
-ATN	41
GROUND	42
-BSY	43
-ACK	44
-RST	45
-MSG	46
-SEL	47
-C/D	48
-REQ	49
-I/O	50

#### NOTES:

1. Pin 38 is reserved for providing optional terminator power (+5 volt).
2. Pins 1 thru 12 and 14 thru 25 shall be connected to ground. Pin 13 should be left open. Some products designed prior to the generation of this standard connected this pin to ground.
3. The minus sign next to the signals indicates active low.

## Differential Cable Pin Assignments

### ALTERNATIVE 1 CONNECTOR

<u>Signal Name</u>	<u>Pin Number</u>		<u>Signal Name</u>
SHIELD GROUND	1	2	GROUND
+DB(0)	3	4	-DB(0)
+Db(1)	5	6	-DB(1)
+DB(2)	7	8	-DB(2)
+DB(3)	9	10	-DB(3)
+DB(4)	11	12	-DB(4)
+DB(5)	13	14	-DB(5)
+DB(6)	15	16	-DB(6)
+Db(7)	17	18	-DB(7)
+DB(P)	19	20	-DB(P)
DIFFSENS	21	22	GROUND
GROUND	23	24	GROUND
TERMPWR	25	26	TERMPWR
GROUND	27	28	GROUND
+ATN	29	30	-ATN
GROUND	31	32	GROUND
+BSY	33	34	-BSY
+ACK	35	36	-ACK
+RST	37	38	-RST
+MSG	39	40	-MSG
+SEL	41	42	-SEL
+C/D	43	44	-C/D
+REQ	45	46	-REQ
+I/O	47	48	-I/O
GROUND	49	50	GROUND

#### NOTES:

1. SHIELD GROUND is optional on some cables.
2. Pins 25 and 26 are reserved for providing optional terminator power (+5 volts).
3. Pin 21 is reserved for providing active high sensing for enabling differential drivers.

## ALTERNATIVE 2 CONNECTOR

<u>Signal Name</u>	<u>Pin Number</u>		<u>Signal Name</u>
SHIELD GROUND	1	26	GROUND
+DB(0)	2	27	-DB(0)
+DB(1)	3	28	-DB(1)
+DB(2)	4	29	-DB(2)
+DB(3)	5	30	-DB(3)
+DB(4)	6	31	-DB(4)
+DB(5)	7	32	-DB(5)
+DB(6)	8	33	-DB(6)
+DB(7)	9	34	-DB(7)
+DB(P)	10	35	-DB(P)
DIFFSENS	11	36	GROUND
GROUND	12	37	GROUND
TERMPWR	13	38	TERMPWR
GROUND	14	39	GROUND
+ATN	15	40	-ATN
GROUND	16	41	GROUND
+BSY	17	42	-BSY
+ACK	18	43	-ACK
+RST	19	44	-RST
+MSG	20	45	-MSG
+SEL	21	46	-SEL
+C/D	22	47	-C/D
+REQ	23	48	-REQ
+I/O	24	49	-I/O
GROUND	25	50	GROUND

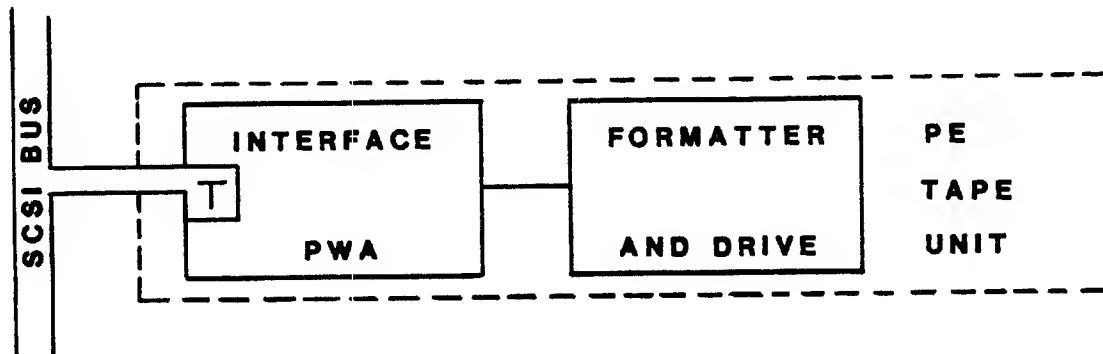
### NOTES:

1. SHIELD GROUND is optional on some cables.
2. Pins 13 and 38 are reserved for providing optional terminator power (+5 volts).
3. Pin 11 is reserved for providing active high sensing for enabling differential drivers.

## SYSTEM CONFIGURATION

The system configuration as shown in figure 1-3 consists of one SCSI PWA and one STU. Either Differential or Single-Ended drivers and receivers are provided for interfacing to the SCSI bus. When the Differential connections are utilized, the maximum cable length is 25 meters. When the Single-Ended connections are utilized, the maximum cable length is 6 meters. Removable terminators are provided.

The STU is required to use shielded cables and connectors to meet FCC and VDE certification. Two connectors are mounted on the drive to facilitate the SCSI bus daisy-chain application.



T = Terminators

Figure 1-3. System Configuration

## SCSI TERMINATION

The STU SCSI interface is configurable to receive terminator power from either the SCSI bus or STU power supply. This option is selected by the hardware jumper described in Appendix A of the Hardware Maintenance Manual, Pub. No. 49768900.

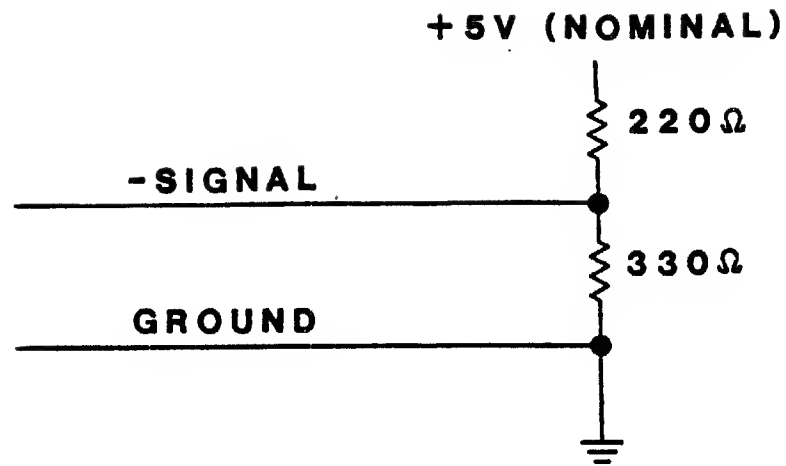


Figure 1-4. Termination For Single-Ended Devices

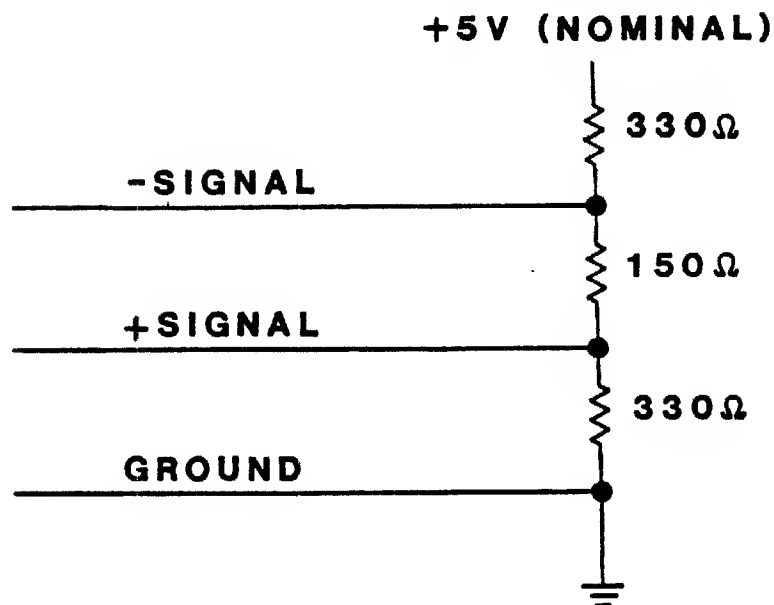


Figure 1-5. Termination For Differential Devices



## COMMENT SHEET

MANUAL TITLE \_\_\_\_\_

PUBLICATION NO. \_\_\_\_\_ REVISION \_\_\_\_\_

FROM: NAME: \_\_\_\_\_  
BUSINESS  
ADDRESS: \_\_\_\_\_

### COMMENTS:

This form is not intended to be used as an order blank. Your evaluation of this manual is welcomed by Laser Magnetic Storage International Company. Any errors, suggested additions or deletions, or general comments may be made below. Please include page number references and fill in publication revision level as shown by the last entry on the Record of Revision page at the front of the manual. Customer engineers are urged to use the TAR.

CUT ALONG LINE

NO POSTAGE STAMP NECESSARY IF MAILED IN U. S. A.

FOLD

FOLD

19403-9990



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY MAIL**

FIRST CLASS

PERMIT NO. 32

NORRISTOWN, PA

POSTAGE WILL BE PAID BY

LASER MAGNETIC STORAGE  
INTERNATIONAL COMPANY  
2621 VAN BUREN AVENUE  
NORRISTOWN, PENNSYLVANIA 19403



ATTN: TAPE STORAGE DIVISION  
TECHNICAL PUBLICATIONS DEPT.

FOLD

FOLD



LASER MAGNETIC STORAGE  
INTERNATIONAL COMPANY  
TAPE STORAGE DIVISION

2621 Van Buren Avenue  
Norristown, PA 19403-2394  
Tel (215) 666 5000  
Fax (215) 666 4691